

Claims

1. An enhancer consisting of the following DNA (a), (b), or (c):

(a) DNA consisting of the nucleotide sequence as shown in any one of SEQ ID NOs: 1 to 4;

(b) DNA consisting of a nucleotide sequence derived from the nucleotide sequence as shown in any one of SEQ ID NOs: 1 to 4 by deletion, substitution, or addition of one or more nucleotides and capable of enhancing gene expression efficiency in motor neurons; or

(c) DNA consisting of a nucleotide sequence capable of hybridizing under stringent conditions to a nucleotide sequence complementary to the nucleotide sequence as shown in any one of SEQ ID NOs: 1 to 4 and capable of enhancing gene expression efficiency in motor neurons.

2. An enhancer consisting of the following DNA (a), (b), or (c):

(a) DNA consisting of any one of a nucleotide sequence consisting of nucleotides 235 to 560 of SEQ ID NO: 1, a nucleotide sequence consisting of nucleotides 204 to 528 of SEQ ID NO: 2, a nucleotide sequence consisting of nucleotides 206 to 530 of SEQ ID NO: 3, or a nucleotide sequence consisting of nucleotides 211 to 555 of SEQ ID NO: 4;

(b) DNA consisting of a nucleotide sequence derived from any one of a nucleotide sequence consisting of nucleotides 235 to 560 of SEQ ID NO: 1, a nucleotide sequence consisting of nucleotides 204 to 528 of SEQ ID NO: 2, a nucleotide sequence consisting of nucleotides 206 to 530 of SEQ ID NO: 3, or a nucleotide sequence consisting of nucleotides 211 to 555 of SEQ ID NO: 4 by deletion, substitution, or addition of one or more nucleotides and capable of enhancing gene expression efficiency in motor neurons; or

(c) DNA consisting of a nucleotide sequence capable of hybridizing under stringent conditions to a nucleotide sequence complementary to any one of a nucleotide sequence consisting of nucleotides 235 to 560 of SEQ ID NO: 1, a nucleotide sequence

consisting of nucleotides 204 to 528 of SEQ ID NO: 2, a nucleotide sequence consisting of nucleotides 206 to 530 of SEQ ID NO: 3, or a nucleotide sequence consisting of nucleotides 211 to 555 of SEQ ID NO: 4 and capable of enhancing gene expression efficiency in motor neurons.

3. The enhancer according to claim 1 or 2, wherein the motoneurons dorsally extend axons.

4. An enhancer consisting of the following DNA (a), (b), or (c):

(a) DNA consisting of the nucleotide sequence as shown in SEQ ID NO: 5;

(b) DNA consisting of a nucleotide sequence derived from the nucleotide sequence as shown in SEQ ID NO: 5 by deletion, substitution, or addition of one or more nucleotides and capable of enhancing gene expression efficiency in sensory neurons; or

(c) DNA consisting of a nucleotide sequence capable of hybridizing under stringent conditions to a nucleotide sequence complementary to the nucleotide sequence as shown in SEQ ID NO: 5 and capable of enhancing gene expression efficiency in sensory neurons.

5. An enhancer consisting of the following DNA (a), (b), or (c):

(a) DNA consisting of the nucleotide sequence as shown in SEQ ID NO: 5 or 6;

(b) DNA consisting of a nucleotide sequence derived from the nucleotide sequence as shown in SEQ ID NO: 5 or 6 by deletion, substitution, or addition of one or more nucleotides and capable of enhancing gene expression efficiency in motor neurons that ventrally extend axons; or

(c) DNA consisting of a nucleotide sequence capable of hybridizing under stringent conditions to a nucleotide sequence complementary to the nucleotide sequence as shown in SEQ ID NO: 5 and capable of enhancing gene expression efficiency in motor neurons that ventrally extend axons.

6. A vector comprising the enhancer according to any one of claims 1 to 5.

7. The vector according to claim 6 further comprising a promoter and a gene comprising a coding region.

8. A transgenic cell line comprising the vector according to claim 6 or 7.

9. A transgenic animal comprising the vector according to claim 6 or 7.

10. A method for regulating gene expression, wherein expression efficiency of a given gene is improved under the control of the enhancer according to any one of claims 1 to 5.

11. A method for regulating gene expression comprising a step of introducing a nucleic acid construct comprising the enhancer according to any one of claim 1 to 5 and the given gene into cells, wherein expression efficiency of the given gene is improved in motor neurons and/or in sensory neurons.

12. A method for evaluating differentiation of pluripotent stem cells comprising a step of introducing a nucleic acid construct comprising the enhancer according to any one of claims 1 to 5, a promoter, and a reporter gene into pluripotent stem cells and a step of inducing the pluripotent stem cells to differentiate, wherein reporter gene expression is assayed to evaluate whether or not the pluripotent stem cells are differentiated into motor neurons or sensory neurons.

13. A method for regenerating motor neurons/sensory neurons comprising steps of:

introducing a nucleic acid construct comprising the enhancer according to any one of claims 1 to 5, a promoter, and a reporter gene into pluripotent stem cells;

inducing the pluripotent stem cells to differentiate;

assaying reporter gene expression to evaluate whether or not the pluripotent stem cells are differentiated into motor neurons or sensory neurons to thereby select motor neurons or sensory neurons; and

transplanting the selected motor neurons or sensory neurons.